



Annotated Bibliography of Selected NPRDC Publications on Total Quality Management

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December 1990
NPRDC-AP-91-04

Introduction

To enhance defense readiness, the Department of the Navy (DON) is beginning to apply a combination of management concepts and analytic methods to improve significant processes within the DON. This new approach to doing business is called Total Quality Management, or TQM.

The management concepts most commonly associated with TQM are those of Dr. W. Edwards Deming, a management theorist credited with helping Japan achieve prominence in the world marketplace through its low-priced, high-quality goods. The prestigious Japanese Deming Prize, awarded to companies and individuals for outstanding accomplishments in quality improvement and management, was named in his honor.

Deming's concepts stress the responsibility managers have for the quality of the products and services provided by their organizations. These 14 concepts, or principles, as Deming calls them, must be instituted by management to ensure a successful transition to TQM (page 2).

The strength of the Deming approach is its explicit emphasis on an active topdown management involvement in quality improvement. Top management commitment has long been noted as one of the most critical factors of any successful organizational innovation. This is particularly true for an approach as encompassing as TQM.

Deming argues that the correction and improvement of a process (i.e., the resources and activities involved in production or service) lead to higher

quality. By removing potential sources of defects through systematic analysis and improvement, services and products can be provided that are timely, defect-free, and economical. Such benefits are of particular concern to the acquisition and logistical functions of the DON.

The Role of NPRDC

The Organizational Systems Department, Navy Personnel Research and Development Center (NPRDC), is conducting research for the Navy concerned with increasing productivity through process improvement.

Research Focus

The Center became involved in TQM efforts in 1983, when research staff began to study the variety of quality improvement approaches being used in public and private organizations. Researchers examined approaches advocated by Juran, Crosby, Kepner-Tregoe, Taguchi, Conway, and others, determining in the end that the approach espoused by Deming was the most comprehensive. The Deming approach was found to embrace all of the important components of a management approach and was consistent with results from research literature on the requirements for fundamental organizational change.

That same year, the Organizational Systems Department became involved in the TQM implementation efforts of a local naval aviation depot. They provided help in interpreting Deming's principles, explaining process analysis methods, and training the organization's facilitators. Later, in that same setting, they taught a course in structured problem solving and in the use of graphic methods, while con-

tinuing to assist process improvement efforts and facilitators. Since then, the Organizational Systems Department has expanded its efforts to include a variety of acquisition and logistical organizations within the DON. The department's main business is to conduct research focusing on how to translate Deming's principles into organizational practice and, subsequently, to evaluate organizational performance. As part of this research, NPRDC conducts on-site consultations and organizational evaluations for the DON.

Quality Support Center

In April 1990, the DON's Executive Steering Group for TQM chartered a Quality Support Center (QSC) to be located in Washington, DC, and at NPRDC, San Diego. One primary function of the QSC is to serve as a DON clearinghouse for TQM information. This publication is one of its products.

About this Publication

To assist DON organizations with their educational process, an annotated bibliography of selected articles describing NPRDC efforts appears here. Abstracts are grouped according to whether they concern TQM principles (page 3), process analysis and improvement methods (page 7), or case studies (page 13).

The reader should note that some of the earlier publications refer to NPRDC research conducted at the Naval Air Rework Facility (NARF), North Island, located in San Diego, California. More recent articles refer to that site as the Naval Aviation Depot (NADEP), North Island.

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Deming's Management Principles¹

1. Create and publish to all employees a statement of the aims and purposes of the company or other organization. The management must demonstrate constantly their commitment to this statement.
2. Learn the new philosophy, top management and everybody.
3. Understand the purpose of inspection, for improvement of processes and reduction of cost.
4. End the practice of awarding business on the basis of price tag alone.
5. Improve constantly and forever the system of production and service.
6. Institute training (for skills).
7. Teach and institute leadership.
8. Drive out fear. Create trust. Create a climate for innovation.
9. Optimize toward the aims and purposes of the company, the efforts of teams, groups, staff areas, too.
10. Eliminate exhortations for the work force.
11. (a) Eliminate numerical quotas for production. Instead, learn and institute methods for improvement.
(b) Eliminate M.B.O. (management by objective). Instead, learn the capabilities of processes and how to improve them.
12. Remove barriers that rob people of pride of workmanship.
13. Encourage education and self-improvement for everyone.
14. Take action to accomplish the transformation.

¹The Quality Leader (Vol. XVI) from *The Deming Library* [16 videotapes]. (1987-1989). Washington, DC: CC-M Productions.

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TQM Principles

Backaitis, N., & Rosen, H. H. (coeditors). (May 1990). *Readings on managing organizational quality* (NPRDC Tech Note 90-19). San Diego: Navy Personnel Research and Development Center.

This volume of readings focuses on organizational transformation and on the overriding management and leadership issues that need to be the cornerstone of TQM efforts. The readings bring together from a wide variety of sources some of the important concepts in managing organizational change. They emphasize that the tools and methods of process analysis and improvement need to be integrated both with the leadership requirements for planning for quality and with research findings on organizational change. Major sections cover the competitive state of U.S. industry; philosophy, management, and leadership for improvement of organizational quality; process improvement; reward systems; accounting systems; and case

studies documenting quality improvement efforts in both service and manufacturing sectors.

Backaitis, N., & Rosen, H. H. (June 1990). *Managing for organizational quality--Theory and implementation: An annotated bibliography* (NPRDC Tech. Note 90-25). San Diego: Navy Personnel Research and Development Center.

This volume provides a resource to those interested in learning about managing organizations for quality improvement. The materials examine the organizational improvement effort from many different angles: the crucial role of the quality philosophy in the guidance of improvement efforts, the role of top management and of quality professionals in organizational improvement efforts, the effect of reward systems on the process of improvement, the use of the scientific method and of statistical thinking in the definition and improvement of organizational processes, and the development of accounting figures that will be more useful in making strategic decisions. Major sections cover the competitive position of U.S. industry; the quality philosophy and management principles for

improving quality, productivity, and competitive position; management of organizational change and transformation; roles of management and leadership; tools for improving work processes; the effect of reward systems on behavior and motivation; teamwork and quality circles; customer-supplier relationships; strategic accounting practices; and statistical education. Materials describing implementation efforts and case histories are included.

Dockstader, S. L. (June 1984). *What to do when there are more than five deadly diseases*. Paper presented at the MIT Conference on Managing Systems and People for Quality Improvement, San Diego, CA.

The author reviews what W. Edwards Deming calls the deadly diseases of management, management practices that represent the principal impediments to improving quality and service in America. Of these five, the one that has particularly pernicious effects on the ability of Navy organizations to improve quality is "mobility of management" (i.e., the built-in transfer of managers-- usually military officers) that precludes the long-term

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constancy of purpose required for the practice of TQM.

Dockstader cites two other problems identified by Navy researchers that probably qualify as "deadly diseases" on a par with Deming's five. The first of these is that *there is not a "felt need" for improvement* of quality and productivity among managers of large Navy organizations. While managers acknowledge the importance of efficiency or effectiveness, most have reported that there are no conditions (e.g., market forces) that mandate significant changes.

The second problem has to do with the *structure of the bureaucracy* that controls Navy organizations. Customers' needs, now and in the future, must become a driving force for quality improvement. Research has revealed that most organizations cannot clearly define who their customers are and have no strategically employed mechanism for determining and responding to their needs. Rather, most organizations respond to requirements from a higher level, such as headquarters, and are often controlled by systems outside of the chain of command (e.g., personnel systems, budgetary and monetary systems). In this bureaucracy there is almost *no way of putting the*

voice of the customer into the process.

Deming advises a top-down and strategically driven overhaul of the practice of management and the organization of work to deal with these "deadly diseases." Dockstader points out while any manager can practice TQM within his/her sphere of influence, the benefits derived will be suboptimal in any organization where leadership of change is absent at the top and no "critical mass" for change has been developed and organized. Who forms the critical mass and what needs to be done have been identified by Deming and others. What is absent is a leadership with sufficient time to effect the needed changes.

Dockstader, S. L. (1986). Japanese quality control: Implications for job and organizational design. In O. Brown, Jr., & H. W. Hendrick (Eds.), *Human factors in organizational design and management-II* (pp. 385-392). Amsterdam: North-Holland.

The "total quality" concept has emerged as the cornerstone for the development of the Japanese economy during the past three decades. The author

examines the principal sources of resistance to this approach within the prevailing practice of management in the United States. First, he examines Lawler's analysis of the factors that contribute to resistance to control systems as they relate to the "total quality" concept. The general conclusion reached is that the existing concept of quality control contains precepts (inspection, audit) related to the "total quality" concept, but that are rooted in assumptions inconsistent with continuous process improvement. Dockstader concludes from this finding that, in most cases, one should not choose to adopt a "total quality" approach using the existing quality control organization.

The author then examines the motivating potential of jobs created by adopting a total quality approach. He uses Hackman's job characteristics theory (JCT) as a conceptual framework for this study. Hackman proposes that there are three psychological states that contribute to worker motivation: These are feelings of meaningfulness, responsibility, and knowledge of results. The theory goes on to describe what job characteristics (e.g., skill variety, autonomy) will result in these feelings.

Dockstader considers each of these characteristics as they

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would apply when quality improvement becomes a part of the job and concludes that quality improvement activities are intrinsically rewarding. JCT could account for the success of the total quality concept, but again it would require adoption of new assumptions on the part of management concerning how quality is improved.

This change in assumptions must be based on a different view of the role of quality in the management of organizations. This "paradigm shift" must take into account seven fundamental requirements for the practice of the total quality concept (e.g., adopting process control and eliminating inspection), and must be put in place by a strategically guided plan for changes in the policies, practices, and structures of the organization. In the absence of extreme market pressures to do so, this can only be accomplished by a knowledgeable critical mass of top managers.

Dockstader, S. L., Doherty, L. M., & Konoske, P. J. (in press). *Introduction to the Deming approach to Total Quality Management*. San Diego: Navy Personnel Research and Development Center.

This publication is intended to serve as the basic text for a one-day introductory course on W. Edwards Deming, his philosophy and approach, with reference to selected readings, viewgraphs, and videotapes. The authors developed and revised the text based on lessons learned from giving over 200 presentations to DON and Department of Defense (DOD) managers. This publication is not to be considered a substitute for the more comprehensive treatment afforded by Deming's published works or his seminars.

The course is divided into four parts: (1) background and definition of TQM; (2) Deming's management philosophy; (3) methods of process analysis, control, and improvement; and (4) process variation and continuous improvement.

Part 1 introduces the reader to common misunderstandings about quality, such as the myth that quality improvement is limited to manufacturing or that high quality can be guaranteed by new technology. The authors explain the differences between the "detection" and "prevention" approaches to quality control. The history of Deming's success in Japan as well as the use of process control methods in Japan and the U.S. are described.

Part 2 describes Deming's "five deadly diseases" and "14 principles" or obligations of management. The authors expand on the 14 principles and provide examples relevant to DOD organizations. In Part 3, the authors present the basic methods and tools of process analysis, control, and improvement. The Plan-Do-Check-Act cycle of Walter Shewhart and its relationship to process improvement are introduced as is the critical role of management in applying these methods. The authors describe the seven basic graphic tools (e.g., control charts) and their role in process analysis. The final section introduces the concepts of variation and continuous improvement and ends with a discussion on the economic justification for continuous improvement.

The report contains exhibits useful for constructing visual aids for presentation as well as a narrative intended to clarify and amplify the information in the exhibits.

Goldberg, E., Hulton, V., Konoske, P., & Monda, M. (May 1987). *Introduction to Total Quality Management: Selected readings* (NPRDC Tech. Note 87-23). San

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Diego: Navy Personnel Research and Development Center. (AD-A181 325)

This technical note orients managers to the basic concepts of TQM. It is not intended to provide a comprehensive study of quality management, but rather to aid in planning for an implementation of the Deming approach to TQM.

The report is organized into four parts. The articles in Section 1 present an overview of quality management, its background and general concepts. The articles define what quality management is, how it has been successfully implemented in Japan, and the impact of Japan's success in gaining the competitive edge. Implementation strategies and practices are treated in Section 2. Section 3 reports on case studies from various organizations. The final section lists other relevant publications produced by NPRDC on the same topic.

The articles are still relevant and timely and have been used by numerous DON organizations as part of their education packages.

Greebler, C., &
Suarez, G. (April 1989).
Total Quality Management

implementation: Selected readings (NPRDC Tech. Note 89-17). San Diego: Navy Personnel Research and Development Center. (AD-A208 155)

In 1988, in response to the publication of a statement entitled "DOD Posture on Quality," DOD managers began to ask for information and examples of TQM implementation. To meet that request, the Office of the Assistant Secretary of Defense (Production and Logistics) asked NPRDC to prepare a set of readings and case studies to assist managers in implementing TQM. This document is intended to serve that purpose. Articles were chosen on the basis of how well they prepared managers to take on these new challenges, including how to apply TQM in white collar, administrative, and service organizations.

The readings are organized into four sections. Section 1, "Management and Leadership Focus," contains an article that reviews efforts of federal agencies to improve the quality, timeliness, and efficiency of their services. Other articles discuss the new roles the quality professional will have in this transformation process.

Articles in Section 2,
"Guidelines for the Development

of TQM," discuss the critical elements and common components needed to initiate a TQM effort. Common elements required for a cultural transformation include top management commitment, focus on continuous improvement and process analysis, extensive use of measurement, customer orientation, long-term commitment and planning, and involvement of all members of the organization.

Section 3, "Quality Improvement Strategy," addresses more specifically the critical elements identified in Section 2. It focuses on requirements for education and training, as well as the integration of procedures for process improvement with an organization made up of cross-functional teams.

Articles in Section 4, "Case Studies: Special Applications of TQM," deal with case studies from the public sector, including DOD, the Internal Revenue Service, and the Equal Employment Opportunity Commission.

Houston, A.,
Shettel-Neuber, J., &
Sheposh, J. P. (June 1986).
*Management methods for
quality improvement based
on statistical process analysis
and control: A literature and*

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field survey (NPRDC Tech. Rep. 86-21). San Diego: Navy Personnel Research and Development Center. (AD-A169 083)

This report presents the findings of a study on statistical process control (SPC) management approaches. These approaches are intended to improve an organization's productivity and product or service quality by reducing variation in the work processes. The study was conducted to identify similarities and distinctions among SPC management approaches, evaluate the use of commercial SPC training packages in normal industrial facilities, and attempt to identify requirements and barriers to implementing SPC management systems in naval industrial facilities.

The authors obtained information for this study through reviews of SPC management literature and visits to private businesses and naval industrial facilities that use SPC management approaches.

Results indicate that SPC management approaches emphasize the use of elementary statistics to monitor and analyze process performance by managers and workers, long-term orientation toward quality improvement,

and increased intraorganizational communication and cooperation. The SPC approaches differed with regard to implementation strategies, quality improvement responsibility, and worker accountability for defects. The review of training packages failed to identify a sole source capable of meeting the requirements of naval industrial facilities for SPC instruction.

Analysis indicated that development of a sound implementation rationale, top management commitment, and long-term resource allocation were some of the critical requirements for implementation of SPC management approaches in naval industrial facilities.

The selection of vendors on the basis of lowest price and the emphasis on appraising short-term, individual performance were identified as some of the barriers to implementation of SPC management approaches in naval industrial facilities.

Monda, M., Thrapp, P., & Goldberg, E. L. (June 1986). *Quality management: An annotated bibliography* (NPRDC Tech. Note 72-86-07). San Diego: Navy Personnel Research and Development Center.

This annotated bibliography is oriented toward readers new to the concept of quality management. It cites materials from several sources, including books, journals, videotapes, and magazines, from both academia and industry. The main body focuses on the concepts and terminology associated with the quality management movement as well as on the components of successful implementation.

Process Analysis and Improvement Methods

Dockstader, S. L. (1987). *Managing TQM implementation: A matrix approach*. Presented at the DON Depot Maintenance Seminar, Gettysburg, PA, November 1987. San Diego: Navy Personnel Research and Development Center.

The author argues that the practice of TQM can only be achieved when top management

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identifies the requirements of TQM and develops a methodological approach to organizational change. Researchers at NPRDC have developed a two-phase process for TQM implementation. The first of the two phases is described here.

The first phase consists of four stages. The first stage is one of educating top managers to the meaning of the "total quality" concept and then helping them to determine the implications for organizational change. During the second stage, a "critical mass" of

managers involved in the change must develop a strategic change plan. The plan must have near-term components (needed to get started) and long-term components (mechanisms put in place to achieve fundamental change). The third stage involves massive training of all employees to change both management practices and the control of work. Finally, in the fourth stage, a support or maintenance system for the practice of "total quality" must be designed and put in place.

The author proposes an "objectives matrix" as a tool that can be used by managers to plan and carry out each of the four stages. Figure 1 presents the skeleton of an objectives matrix. Examples of TQM objectives are identified across the top of the matrix. The cells are intended to contain objectively stated descriptions of the steps required to fully satisfy those objectives. If "customer satisfaction" were the objective, then cell "0" could be used to represent the fact that "all principal customers are dissatisfied and cancelling orders"; "5"

		Management Commitment	TQM Training	Customer Satisfaction	Vendor Quality	Process Capability	Cost of Quality	Planning and Managing
Performance								
Score	10 ●●●							
	9 ●●●							
	8 ●●●							
	7 ●●●							
	6 ●●●							
	5 ●●●							
	4 ●●●							
	3 ●●●							
	2 ●●●							
	1 ●●●							
	0 ●●●							
Score Weight Value								

Figure 1. Objectives matrix format with examples of TQM objectives.

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could mean that "50 percent are satisfied, 40 percent are indifferent, and 10 percent are dissatisfied"; and "10" could describe the customers who are bragging about the product and sending new customers to the organization.

Dockstader illustrates how the objectives matrix can be used to assess progress in TQM implementation. Principal elements of TQM are identified (e.g., to plan to achieve and maintain competitive position) as well as the objectives that support them (e.g., customer satisfaction). Then each objective is scored according to how much progress has been achieved (i.e., which cell best describes the organization's actions). The scores can indicate opportunities for improvement and can be used to develop an implementation strategy. Other uses of the objectives matrix for the practice of TQM are also discussed.

Houston, A., & Dockstader, S. L. (December 1988). *A Total Quality Management process improvement model* (NPRDC Tech. Rep. 89-3). San Diego: Navy Personnel Research and Development Center. (AD-A202 154)

This report proposes a model for the systematic improvement of an organization's products or services through analyzing and correcting the processes that create them. The model is an elaboration of the Plan-Do-Check-Act (PDCA) cycle developed by Shewhart and Deming for process analysis and improvement. The thrust of this project was to enhance the performance of naval logistics organizations through the application of TQM principles and methods.

The report describes an approach to integrating the procedures of process improvement with an organization made up of cross-functional teams to improve both vertical and horizontal communication. The authors provide a detailed description of the roles and activities of two important teams--Quality Management Boards and Process Action Teams--and how they function within the context of the PDCA cycle. The appendices include an exercise for developing a process flowchart, exercises in creating Pareto charts, a format to follow in writing up a case study, and a fictitious case study to demonstrate the use of the format.

Houston, A., Hulton, V., Landau, S., Monda, M., & Shettel-Neuber, J. (March 1987). *Measurement of work processes using statistical process control: Instructor's manual* (NPRDC Tech. Note 87-17). San Diego: Navy Personnel Research and Development Center. (AD-A179 169)

This report contains the instructional materials for trainers of basic statistical methods used in process quality control, generally referred to as statistical process control or SPC. The materials were developed as a classroom aid for implementing the statistical methods and techniques described by Ishikawa in his *Guide to Quality Control* (1976); the intended audience were managers and workers in Navy industrial activities.

The use of SPC is intended to maximize product quality through control of work processes rather than through postproduction inspection. SPC involves identification and removal of systemic causes of defects, a process that ultimately leads to reduction in process variation.

The course is comprised of 10 sessions. Each session is divided into two parts, a lecture presentation and a hands-on,

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problem-solving laboratory. In the lecture portion, the authors provide guidance in the use of seven graphic methods--how to construct them, when to apply them, and how to interpret them. The seven include flow charts, cause-and-effect diagrams, Pareto diagrams, histograms, scatter diagrams, run charts, and control charts.

These simple statistical tools help to describe processes and display important process data in such a way that problems become more readily apparent and solutions easier to determine. During the lab portion of each session, the student applies the methods to hypothetical problems.

Greebler, C., & Suarez, G. (April 1989). *Strategy for educating the Department of Defense acquisition work force in Total Quality Management* (NPRDC Tech. Note 89-19). San Diego: Navy Personnel Research and Development Center. (AD-A208 222)

This strategy provides broad guidelines for planning and coordinating a TQM education and training program for the Department of Defense (DOD)

acquisition work force. The strategy is organized around short-, mid-, and long-range goals. It also describes resources available to DOD training developers and managers who will subsequently be responsible for TQM education. Included in this strategy is a description of the educational requirements for a TQM awareness program directed at senior-level managers and general managers. A methodology for training development is also proposed.

Greebler, C., & Suarez, G. (July 1989). *An education and training strategy for Total Quality Management in the Department of Defense* (Tech. Note 89-28). San Diego, CA: Navy Personnel Research and Development Center. (AD-A211 942)

This report presents a strategy for educating the Department of Defense (DOD) work force in TQM. The strategy has two objectives. The first is to describe the educational requirements for a TQM awareness program for managers that provides them with an overview of TQM principles and concepts. The second is to describe program

goals, guidelines, and resources available to DOD training developers and managers who will be responsible for follow-on education.

The authors address other related issues, such as the need for special focus on senior management education and for application of new technology (e.g., interactive video) to the education process.

Landau, S. B. (April 1986). *Total quality control as an organizational change process: Implementation requirements*. Paper presented at the Tenth Symposium on Psychology in the Department of Defense, Colorado Springs, CO.

The Navy is interested in implementing the process control principles and procedures of TQM in many of its agencies. This paper discusses issues associated with the implementation of organizational change, in general, and of TQM, in particular, in the naval aviation depot community. Based on research literature and interviews with individuals at organizations operating under various types of process control systems, the author identified six major implementation categories:

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(1) top management orientation, (2) corresponding structural changes (in management and administration), (3) training, (4) quality improvement actions, (5) support activities, and (6) system expansion.

Landau describes 35 steps or activities within these six categories that should be undertaken for successful implementation of TQM. Early activities are largely educational, concerned with orientation of top managers to TQM concepts. A product of this activity is an organizational mission statement developed by the top managers. Educational efforts later extend to middle managers and others who will be involved in the effort. An implementation plan is also developed at this time. In Step 7, an Executive Steering Committee is formed to oversee implementation. Quality Management Boards (QMBs) and project teams are later organized (Step 9). By Step 17, statistical training is occurring, and, by Step 19, the QMBs and project teams are conducting process investigations. Later activities are directed at establishing a TQM library, selecting in-house trainers, and identifying a statistical consultant. Finally, the successful quality management efforts are institutionalized and the implementation is expanded to other sites within the organization.

Landau, S. (March 1987). *Training in statistical process control at the Naval Air Rework Facility, North Island: A Total Quality Management implementation tool* (NPRDC Tech. Note 87-18). San Diego: Navy Personnel Research and Development Center.

This report describes the results of TQM training conducted by NPRDC researchers at the NARF, North Island, between December 1984 and April 1985. Educational activities were initially directed at top management and consisted of an introduction to the principles of TQM. A workshop was then held to help them develop their own implementation guidelines. The third activity consisted of a more comprehensive exposure of top managers to TQM principles. The final effort was directed at middle managers, first-line supervisors, and others involved in the pilot effort who had no prior exposure to TQM. The training phase consisted of classroom instruction on the use of the statistical tools associated with TQM. A 30-hour course consisting of 10 sessions was developed and conducted during March-April 1985. Each session was divided into a lecture/discussion and a laboratory.

Overall evaluation of the training was positive. Of particular note was the perception by the students that management was committed to implementing the statistical techniques. Training of in-house trainers by NPRDC staff is underway so that the NARF can take over the training program.

Sheposh, J. P., & Shettel-Neuber, J. (December 1986). *Assessment of aspects of an organization important to the implementation of a quality improvement effort* (NPRDC Tech. Rep. 87-12). San Diego: Navy Personnel Research and Development Center. (AD-A175 299)

This technical report documents an assessment of a naval aviation depot implementing an organization-wide quality control effort. The research was designed to assess aspects of the organization likely to promote or inhibit such an effort. A technical analysis and system scan were performed to study the work process. In addition, two questionnaires were designed, one to determine the nature of the management system, as perceived by four levels of managers, and one to measure job characteristics and impediments, as perceived by

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nonsupervisory personnel and their first-line supervisors.

The technical analysis revealed that the overall work process was complex, required coordination of many people and departments, and was subject to disruption and problems. The managerial system was characterized by a moderate amount of cooperative teamwork and some subordinate input, but it fell short of a system where ideas and methods of process control are communicated readily and accurately. At the individual job level, the majority of impediments to optimal performance were found to be management system problems.

The results provide a picture of the state of the organization in terms of the quality improvement effort at the time of the assessment as well as information useful in planning and guiding the effort over time.

Recommendations to improve quality control and product quality include (1) placing emphasis on procedures and processes rather than inspection, (2) designing variance process control procedures that cut across departmental or functional lines, and (3) emphasizing operating efficiency. Periodic assessment is important to measuring the

Quality of Conformance vs. Quality of Design

Readers should note that, with one exception, the case studies were developed from quality improvement efforts in logistical support organizations. While the TQM principles and methods for process improvement have general applicability across service and production processes, there are some critical distinctions between the quality goals of acquisition and logistical organizations.

Logistical organizations tend to be concerned with "quality of conformance." This form of quality refers to the ability of a process to provide a product or service that exhibits little or no variation from specifications. In other words, it focuses on **how effectively and reliably products and services are created.** In the case of Navy logistical organizations, this form of quality is translated into how well ships and aircraft are maintained to meet the operational requirements of the Fleet. Improving quality of conformance tends to focus on the people, methods, materials, and machines used in a service or production process. Such processes are analyzed and tested with the purpose of removing sources of variation that could lead to waste and defects.

In contrast, acquisition organizations are primarily concerned with "quality of design." This form of quality is based on **how well the product or service meets the actual needs of the user.** In the case of Navy acquisition organizations, the ultimate concern is providing equipment and other resources to meet the strategic and tactical needs of the Fleet. Improving design depends heavily on the clear identification and definition of user requirements; this involves extensive user feedback and complex design testing and experimentation.

The distinction between quality of conformance and quality of design is made as a caution to readers from the DOD and DON acquisition communities. Efforts to achieve quality of conformance in an acquisition process could lead to the more efficient procurement of inferior vendor products and services.

Navy acquisition organizations have just begun the extensive educational process needed to implement TQM. Thus, there is no body of case studies depicting quality of design applications in Navy acquisition processes.

extent to which impediments to quality control have been removed.

Sheposh, J. P., & Shettel-Neuber, J. (1986). Contribution of a multi-method approach to understanding implementation. In O. Brown, Jr., & H. W. Hendrick (Eds.), *Human factors in organizational design and management-II* (pp. 655-660). Amsterdam: North-Holland.

This article describes TQM implementation efforts underway at the Naval Air Rework Facility, North Island. To collect information useful to the development of a theory of total quality control within such a setting, the authors tapped three sources of information: (1) perceptions of 59 artisans concerning the aspects of the organization that impede work performance, (2) case studies reflecting day-to-day implementation, and (3) organizational characteristics as determined by Likert's Profile of Organizational Characteristics.

Although each source of information is useful, together they make up a powerful diagnostic tool that can provide continuous

feedback to those involved in an implementation effort.

Overall, the results of this continuing assessment may help to determine the interrelationships between implementation and aspects of the organization, leading to the development of a theoretical model and the identification of components important to such an endeavor.

Case Studies

McDaniel, D. M., & Doherty, L. M. (February 1990). *Total Quality Management case study in a Navy headquarters organization* (Tech. Note 90-10). San Diego, CA: Navy Personnel Research and Development Center.

This report documents the efforts of Fleet Support and Field Activity Management (AIR-04), Naval Air Systems Command, to implement TQM. It describes AIR-04's TQM implementation plan and its selection of the engineering change proposal (ECP) as the first process to undergo

continuous improvement using TQM methodology. The report chronicles the development of a TQM Executive Steering Committee and Quality Management Board (QMB), the education and training process, and the selection of the ECP process for analysis. Flow charts and statistical control charts were especially useful during process analysis. Flow charting helped to identify areas where concurrent review would be beneficial, and control charts allowed the QMB to identify variation that was out of control.

The QMB is moving into a second round of the Plan-Do-Check-Act cycle. It learned during the initial go-around that timeliness of ECPs was of less importance than financial and schedule executability, completeness and accuracy of documents, and clarity of implementing instructions. Focus will be on these areas in the future.

Recommendations address process definition, work prioritization, just-in-time training, emphasis on immediate results, and documentation of future actions.

Shettel-Neuber, J., & Sheposh, J. P. (June 1986). *Case study of a quality management effort at the Naval*

Annotated Bibliography of Selected NPRDC Publications on Total Quality Management

Air Rework Facility, North Island, California (NPRDC Tech. Note 72-86-09). San Diego: Navy Personnel Research and Development Center.

This technical note reports four case studies documenting quality improvement activities that have been carried out in the Components and Metal Building at the Naval Air Rework Facility, North Island, California, to upgrade quality at Navy industrial facilities. The authors describe activities of quality management boards and project teams that deal with production and support issues. They discuss (1) team accomplishments in terms of higher quality and improved operating efficiency, (2) team activities that are consistent with a total quality control approach, and (3) areas requiring attention if the implementation effort is to succeed.

Shettel-Neuber, J., & Sheposh, J. P. (February 1988). *Process restructuring as a means for improving an aircraft overhaul program* (NPRDC Tech. Note 88-21). San Diego: Navy Personnel Research and Development Center. (AD-A192 538)

This case study documents improvements in F-14 aircraft overhaul at a naval industrial facility that resulted from a team's analysis and redesign of work processes. The team revised and optimized the overall work plan for F-14 overhaul based on information obtained through the disassembly of a test aircraft by skilled artisans.

Paperwork that directs the overhaul was modified to reflect changes in the work process, and general housekeeping was performed in the aircraft disassembly areas. Benefits of the team's efforts included improvements in the work processes and in the overall efficiency of the F-14 overhaul program, leading to reduced turnaround time.

The case study demonstrates the value of focusing on process analysis and restructuring to improve an overall operation, the types of process improvements that can lead to better outcomes, and the role of management in support of such an effort.

Shumate, E. C. (December 1985). *Implementation of quality management in a Navy maintenance activity*. Paper presented at

the Department of Defense Productivity Conference, Leesburg, VA.

This paper describes an effort to design, implement, and evaluate a quality management program at the Naval Aviation Depot (NADEP), San Diego. The primary business of the NADEP is the overhaul, repair, and modification of aircraft, engines, and aeronautical components. It employs over 6,000 employees representing some 52 trade skills.

This pilot project is employing statistical process control and operates under the management philosophy of W. Edwards Deming. The project was initiated in a division within a production department. The work performed in the division involves a cross-section of people from major departments at the NADEP.

In an effort to provide a common knowledge base for all employees, the NPRDC and NADEP managers developed an education and training package, beginning with an orientation session and "awareness" training. A second course entitled "Structured Problem Solving and the Basic Graphic Methods" followed.

Managers began to work on principles espoused by Deming that could be readily

adopted and that would address immediate needs. One of them⁴ concerned the breaking down of barriers between departments by encouraging effective two-way communication. Quality Management Boards were established at each hierarchical level. Yet to be established are the primary roles each Board is to assume.

Sorensen, S. W., Dockstader, S. L., & Molof, M. (October 1985). The use of sociotechnical analysis and statistical process control to develop a quality improvement program. *Proceedings of the 29th Annual Meeting of the Human Factors Society, 1*, 603-607.

Researchers using a sociotechnical systems approach consider every organization in terms of people (the social system) who use tools, techniques and knowledge (the technical system) to produce goods or services valued by customers (who are part of the organization's external

environment). The authors describe a sociotechnical systems analysis that was conducted at a Navy warehouse complex to detect the factors (variances) that detract from the effective operations of the organization. They employed a sociotechnical systems analysis to study the inputs, processes, and outputs of a Navy warehouse complex.

The analysis identified the key variances that require control to maintain and improve quality and productivity. Existing data from the warehouse were analyzed using several statistical process control techniques (run charts and control charts) and presented to managers. This information provided them with new insights into system capabilities and performance and demonstrated the usefulness of sociotechnical systems analysis in studying processes in Navy organizations.

Sorensen, S., Dockstader, S. L., & Molof, M. J. (May 1986). *Developing a statistical*

process control for supply operations (NPRDC Tech. Rep. 86-16). San Diego: Navy Personnel Research and Development Center. (AD-A168 277)

This report documents a cooperative effort between the Navy Personnel Research and Development Center and the Naval Supply Center at Oakland to develop a pilot project on quality control of supply operations using statistical process control (SPC). Although SPC is not a new methodology, its application to a military supply center is innovative. An important feature of this research was the use of a technical evaluation procedure to determine variance points where SPC procedures should be applied. The report describes the first three phases of the pilot project: (1) the technical analysis of the supply functions to be controlled, (2) the procedures for data collection and analysis, and (3) some applications of SPC methods to supply operations.



For Further Information

Most of the publications cited here are available through the Defense Technical Information Center (DTIC), Building #5, Cameron Station, Alexandria, VA 22304-6145, (202) 274-7633 or AUTOVON 284-7633.

Publications cited here without reference to a report number or an AD number are only available through the DON Quality Support Center, Navy Personnel Research and Development Center, San Diego, CA 92152-6800, (619) 553-0577 or AUTOVON 553-0577.